VLAN - SP6510P8

2013/4

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Agenda

- VLAN
- Protocol VLAN
- Voice VLAN

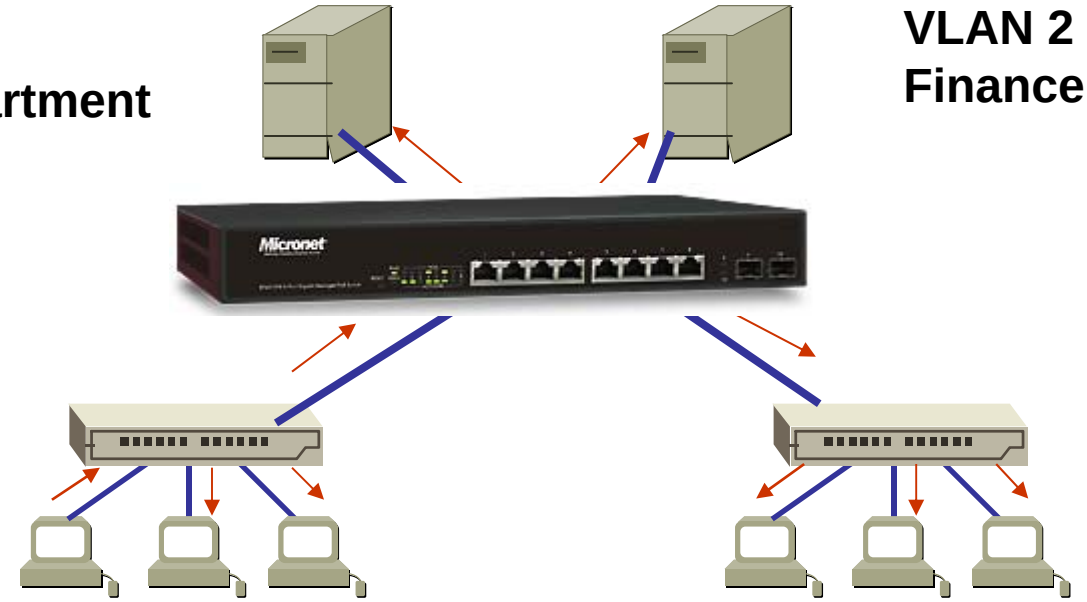
Benefit

- Bandwidth Preservation
- LAN security
- Easy network management

Broadcast /multicast stream

VLAN 1
R&D Department

VLAN 2
Finance Department

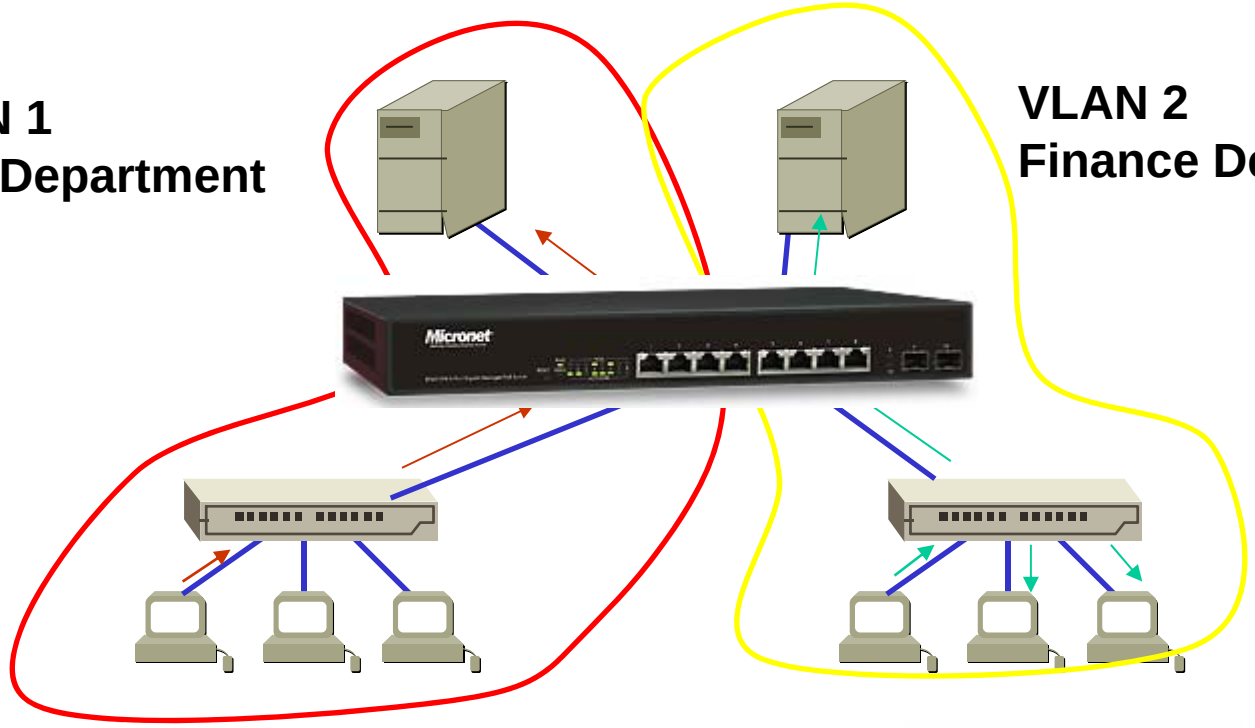


ARP
NetBIOS
IPX GNS
SAP
RIP

Broadcasts consume bandwidth
Each device must process the broadcast frame

Bandwidth Preservation

VLAN 1
R&D Department

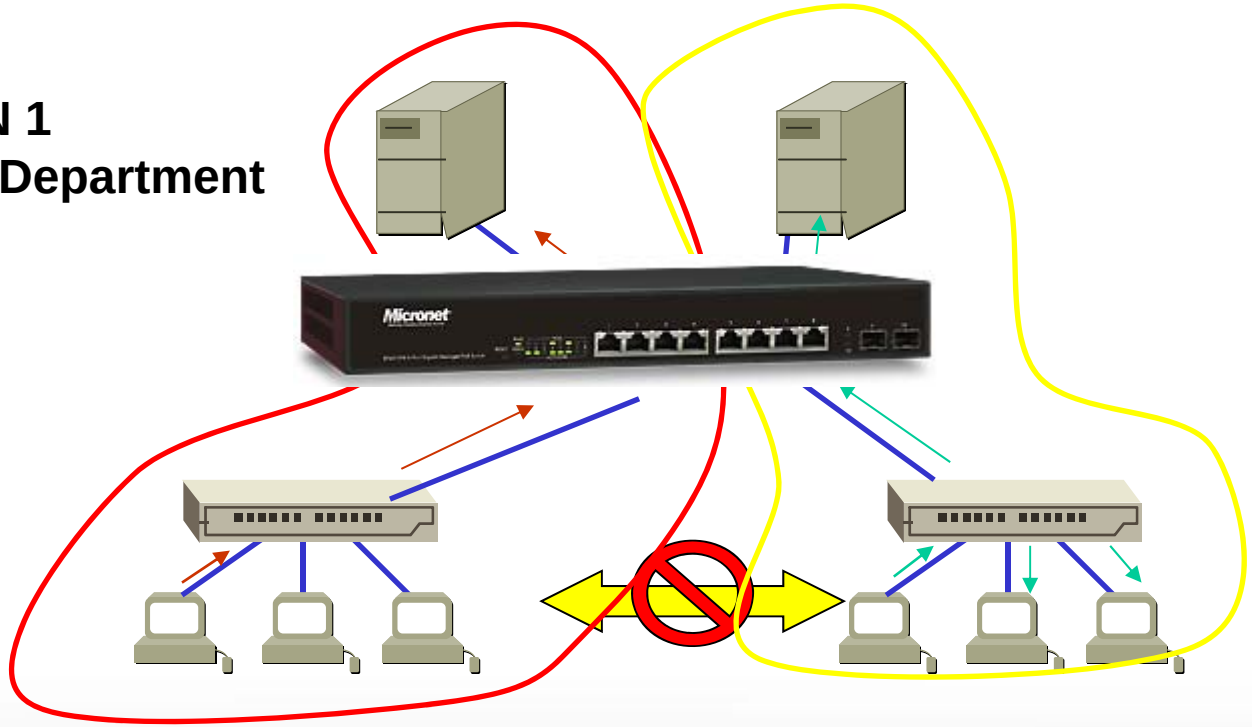


VLAN 2
Finance Department

VLANs contain broadcast traffic

LAN security

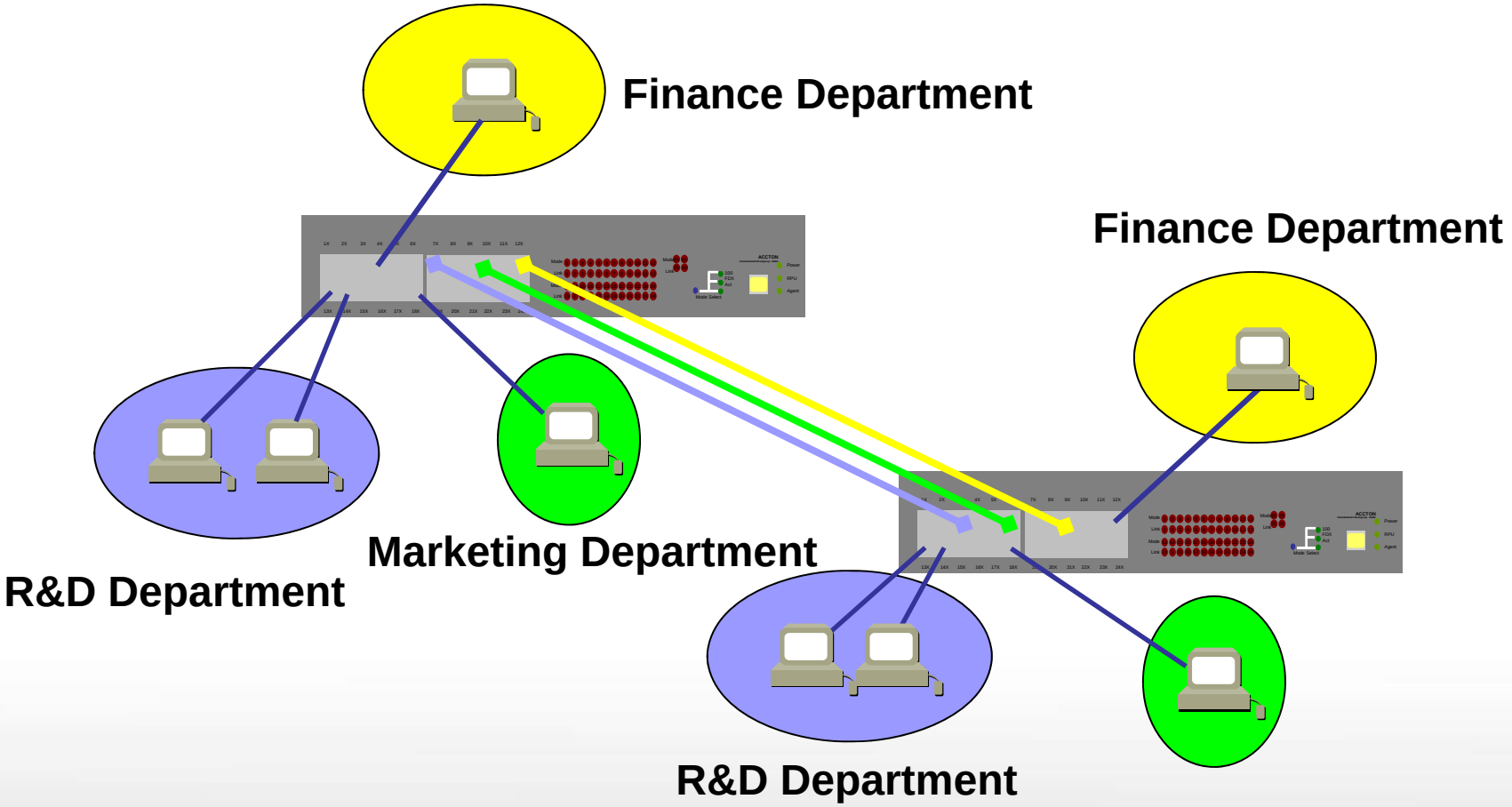
VLAN 1
R&D Department



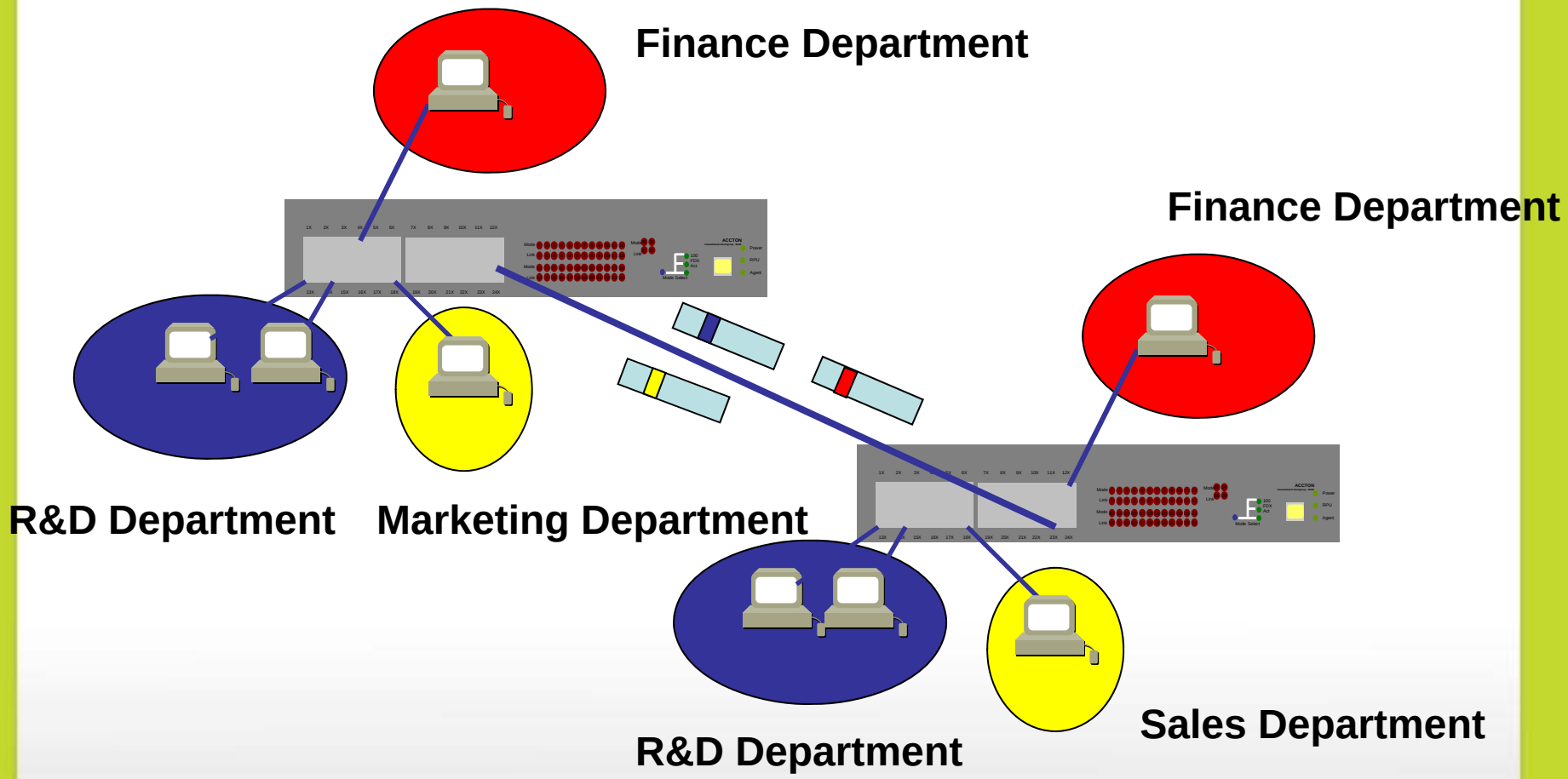
VLAN Introduction

- Port-Based VLAN
- IEEE 802.1Q Tagged VLAN
- Tagging Format
- Tag Control Information
- Ingress & Egress Rules
- VLAN Operation LAN security

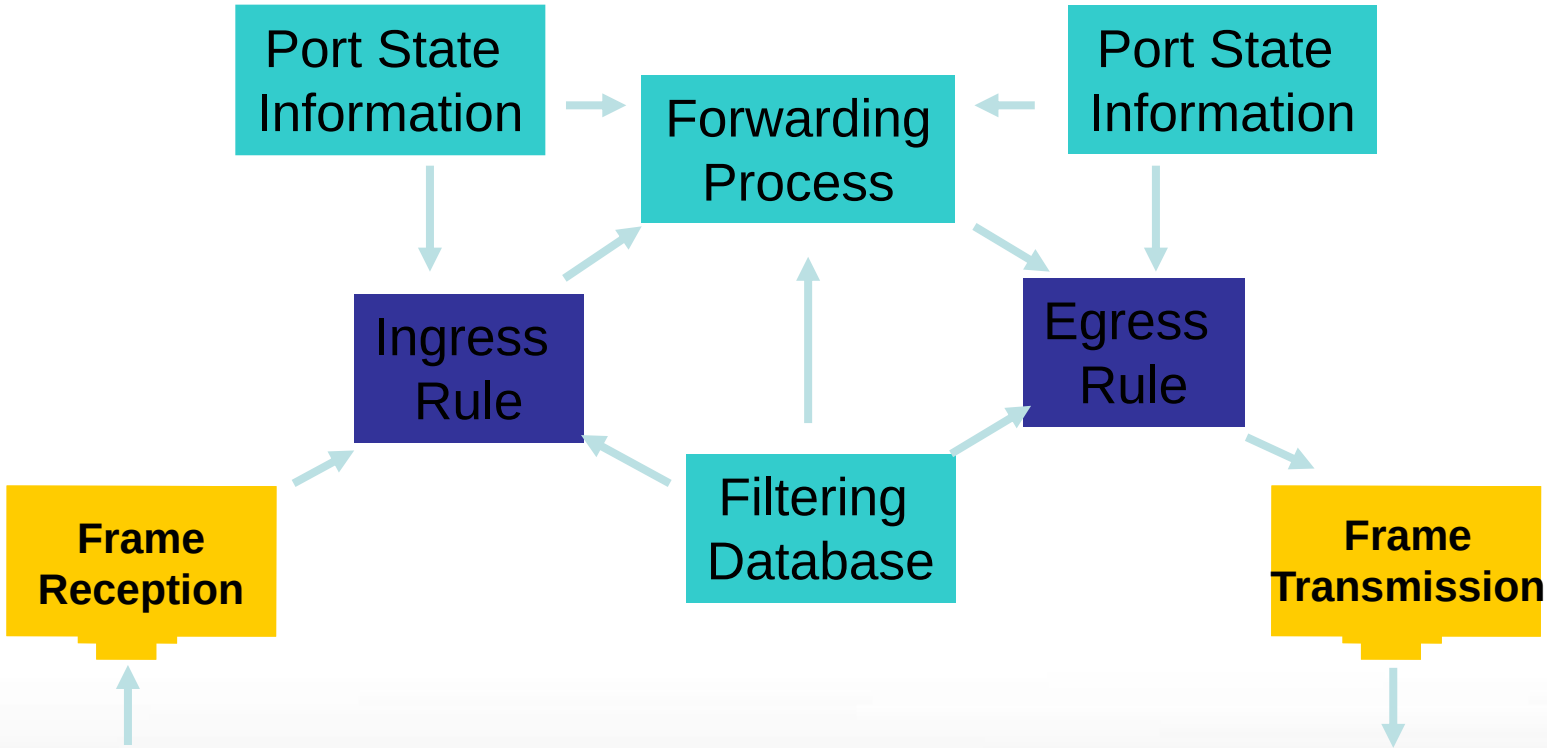
Legacy Port-Based VLAN



IEEE 802.1Q Tagged VLAN



Relaying MAC Frame



Ingress Rules

- Acceptable frame types
  - Admit only VLAN-tagged frames
  - Admit all frames
  - Admin only untagged frames
- Port VLAN Identifier (PVID)
  - Provides the VID for untagged and Priority tagged frames received
- Enable Ingress Filtering (Ingress Filtering)
  - The ingress rules shall discard any frame received on the port whose VLAN classification does not include that port in its member set.
  - SP6510P8-Smart default is Disable Ingress Filtering .

Ingress Rule-Port type(1)

- C-port
  - Port aware VLAN tagged.
  - For customer ports, each frame is assigned to the VLAN indicated in the VLAN tag, and the tag is removed.
- Unaware
  - Port unaware tagged
  - All frames are classified to the Port VLAN ID and tags are not removed.

Ingress Rule- Port Type(2)

- S-port
  - For service ports, the EtherType of all received frames is changed to 0x88a8 to indicate that double-tagged frames are being forwarded across the switch. The switch will pass these frames on to the VLAN indicated in the outer tag. It will not strip the outer tag, nor change any components of the tag other than the EtherType field.
- S-Custom-port
  - For custom service ports, the EtherType of allreceived frames is changed to value set in the Ethertype for CustomS-ports field to indicate that double-tagged frames are being forwarded across the switch. The switch will pass these frames on to the VLAN indicated in the outer tag. It will not strip the outer tag, nor change any components of the tag other than the EtherType field.

Egress Rules(1)

- Port VLAN Mode

- None
  - The ID for the VLAN to which this frame has been assigned is inserted in frames transmitted from the port. The assigned VLAN ID can be based on the ingress tag for tagged frames, or the default PVID for untagged ingress frames.
  - Note that this mode is normally used for ports connected to VLAN-aware switches.

- Specific
  - A Port VLAN ID can be configured (as described below).
    - Untagged frames received on the port are classified to the Port VLAN ID(PVID).
    - If Port Type is Unaware, all frames received on the port are classified to the Port VLAN ID.
    - If the classified VLAN ID of a frame transmitted on the port is different from the Port VLAN ID, a VLAN tag with the classified VLAN ID is inserted in the frame.

Egress Rules(2)

- VLAN member

Determine for a given VLAN, through which ports frames may be transmitted

- TX Tag

Determine in what format (Tagged, Untagged, or Untag_pvid) should the frames be transmitted

Filtering Database Architecture

- Shared VLAN Learning

Allow address information learnt in one VLAN to be shared with the other VLAN

Achieved by using destination MAC address as the searching key

- Independent VLAN Learning

Address information learnt in one VLAN is not shared with other VLAN

Achieved by using both destination MAC address and VID as the searching keys

VLAN Configuration

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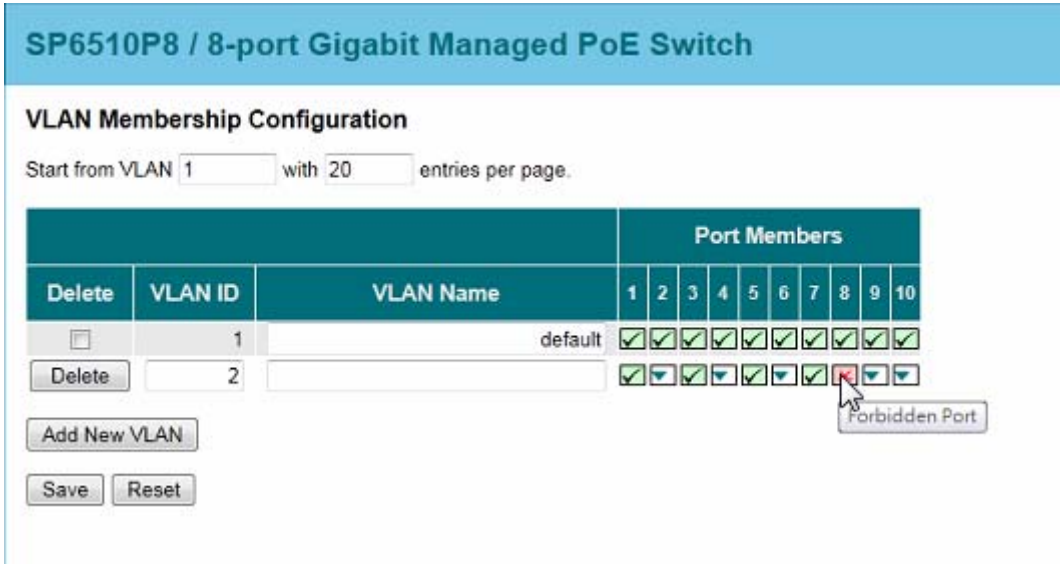
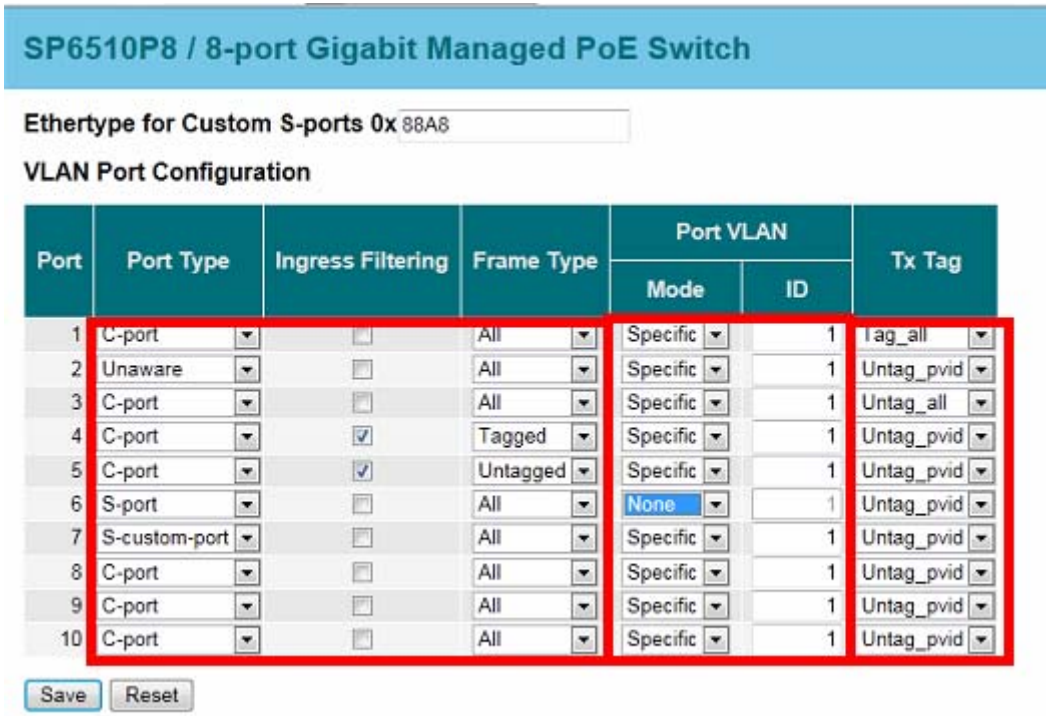
Configuration → VLAN →VLAN membership



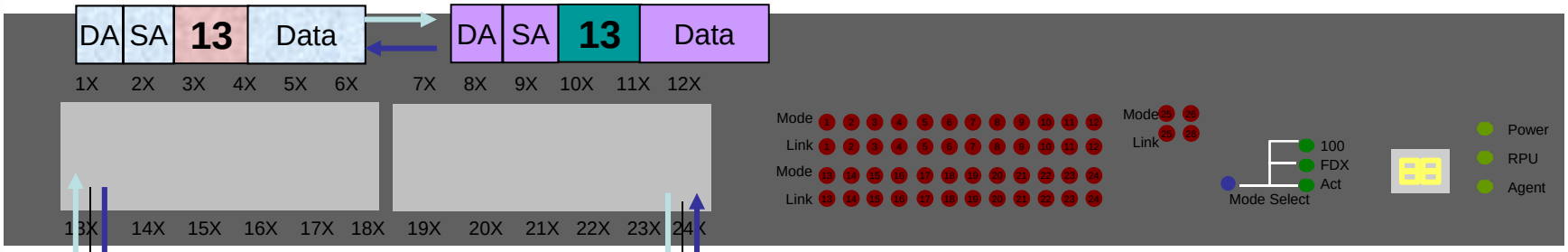
VLAN Configuration

Micronet
Making Communication Easier

Configuration → VLAN → Port


SP6510P8 / 8-port Gigabit Managed PoE Switch
Ethertype for Custom S-ports 0x 88A8
VLAN Port Configuration
Port
Port Type
Ingress Filtering
Frame Type
Port VLAN
Mode
ID
Tx Tag
1 C-port All Specific 1 Tag_all
2 Unaware All Specific 1 Untag_pvid
3 C-port All Specific 1 Untag_all
4 C-port Tagged Specific 1 Untag_pvid
5 C-port Untagged Specific 1 Untag_pvid
6 S-port All None 1 Untag_pvid
7 S-custom-port All Specific 1 Untag_pvid
8 C-port All Specific 1 Untag_pvid
9 C-port All Specific 1 Untag_pvid
10 C-port All Specific 1 Untag_pvid
Save
Reset

VLAN Operation



VID=13 UNTAG
Egress Rule

Egress Rule
Vid=13 Untag

Ingress Rule
PVID=13

DA SA Data

Untag frame

DA SA Data

Untag frame

Host A

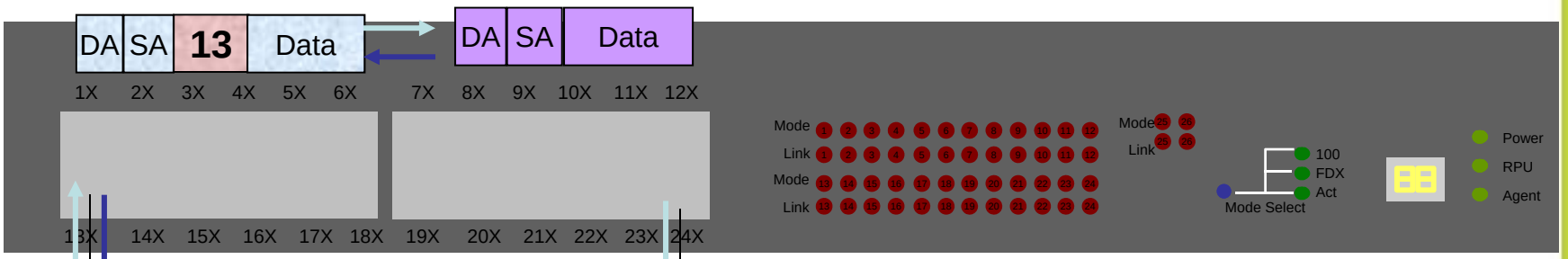
Host B

VLAN Table

VID	MAC	Tagged
13	13,24	u,u

Port	MAC	VID
13	Mac A	13
24	Mac B	13

C-port & Unaware port



VID=13 UNTAG
Egress Rule

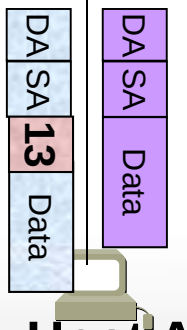
Egress Rule
Tx=PVID_untag
PVID=30

C-port

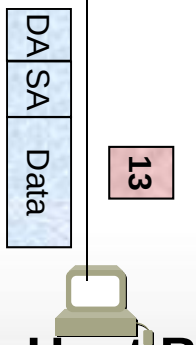
PVID=13

DA SA

Data



tag frame



tag frame

Host A

Host B

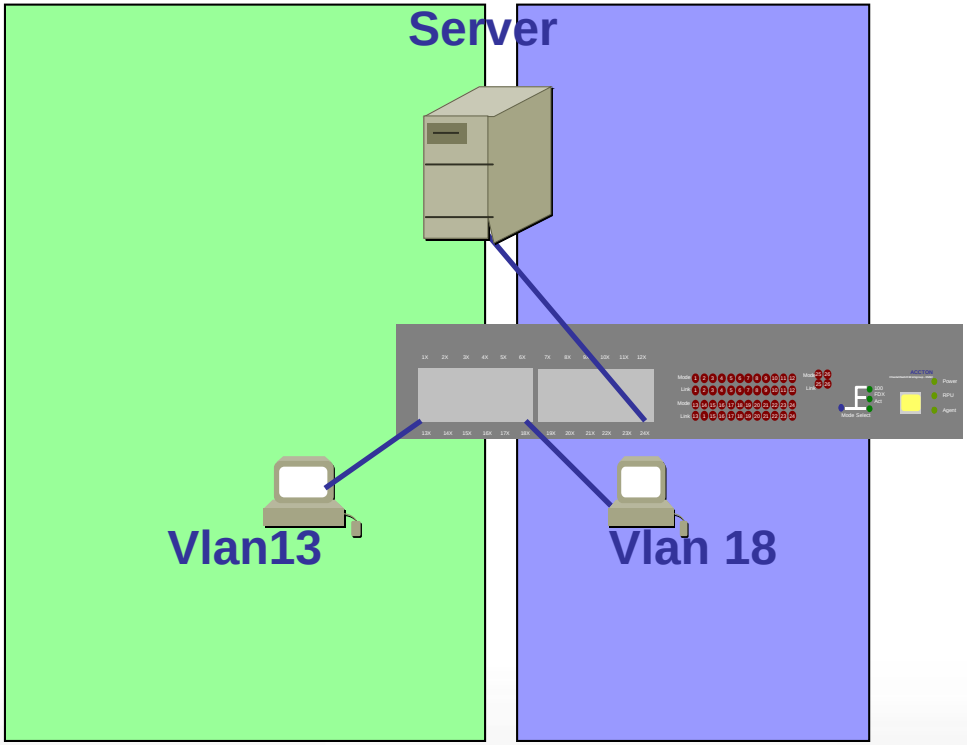
VLAN Table

VID	MAC	Tagged
1	1,2…23	u,u…u
13	13,24	u,u

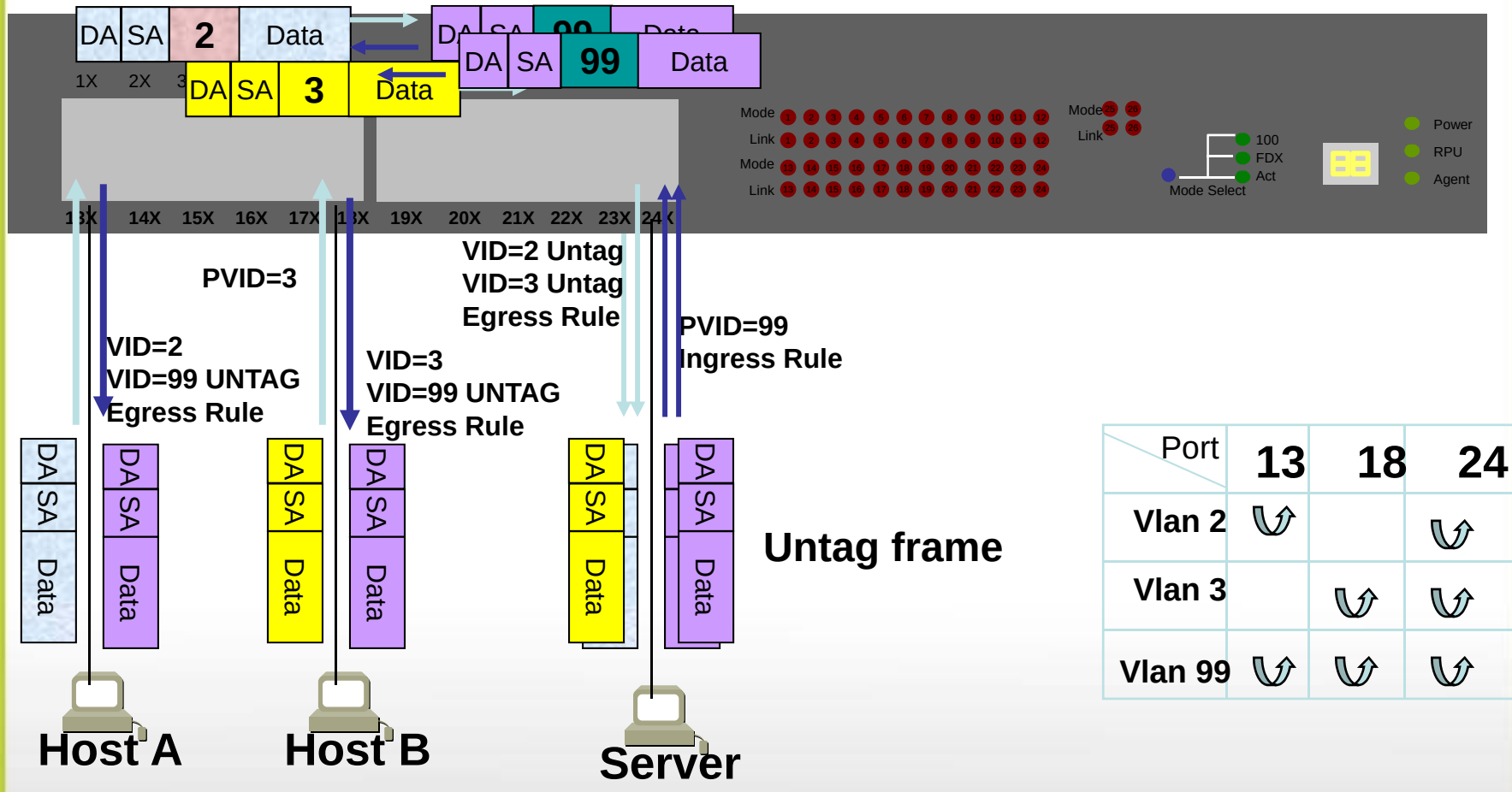
MAC Address Table

Port	MAC	VID
13	Mac A	13
24	Mac B	13

VLAN Overlapping



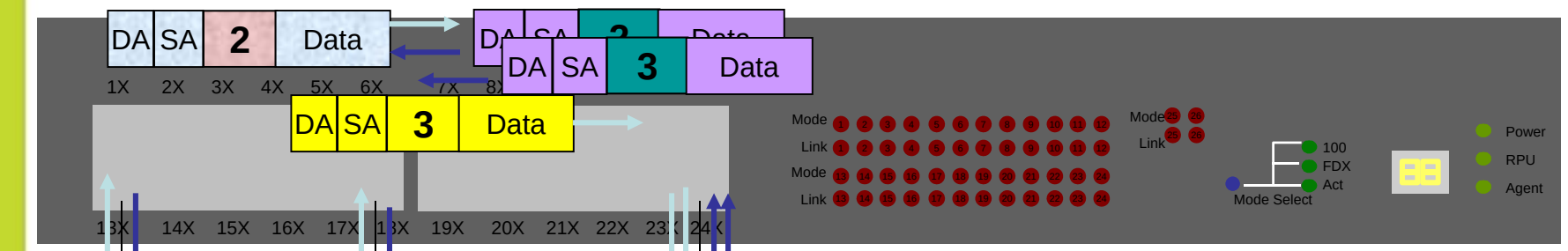
Port-Based VLAN Overlapping



Untag frame

Port	13	18	24
Vlan 2	↺		↺
Vlan 3		↺	↺
Vlan 99	↺	↺	↺

802.1Q Tagged VLAN



PVID=3

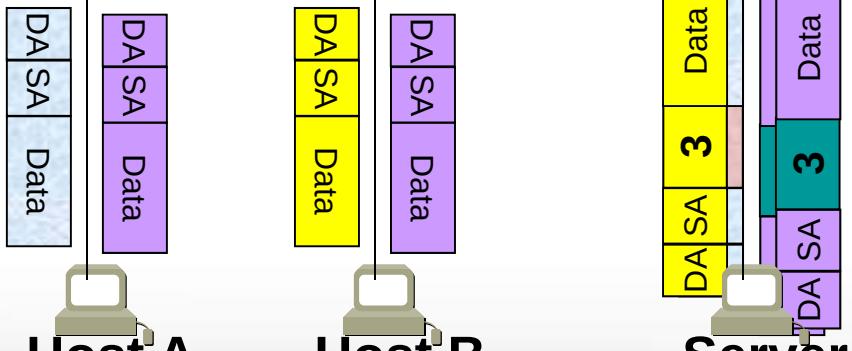
VID=2 TAG
VID=3 TAG
Egress Rule

PVID=1
Ingress Rule

PVID=2
Ingress Rule

VID=2 UNTAG
Egress Rule

VID=3 UNTAG



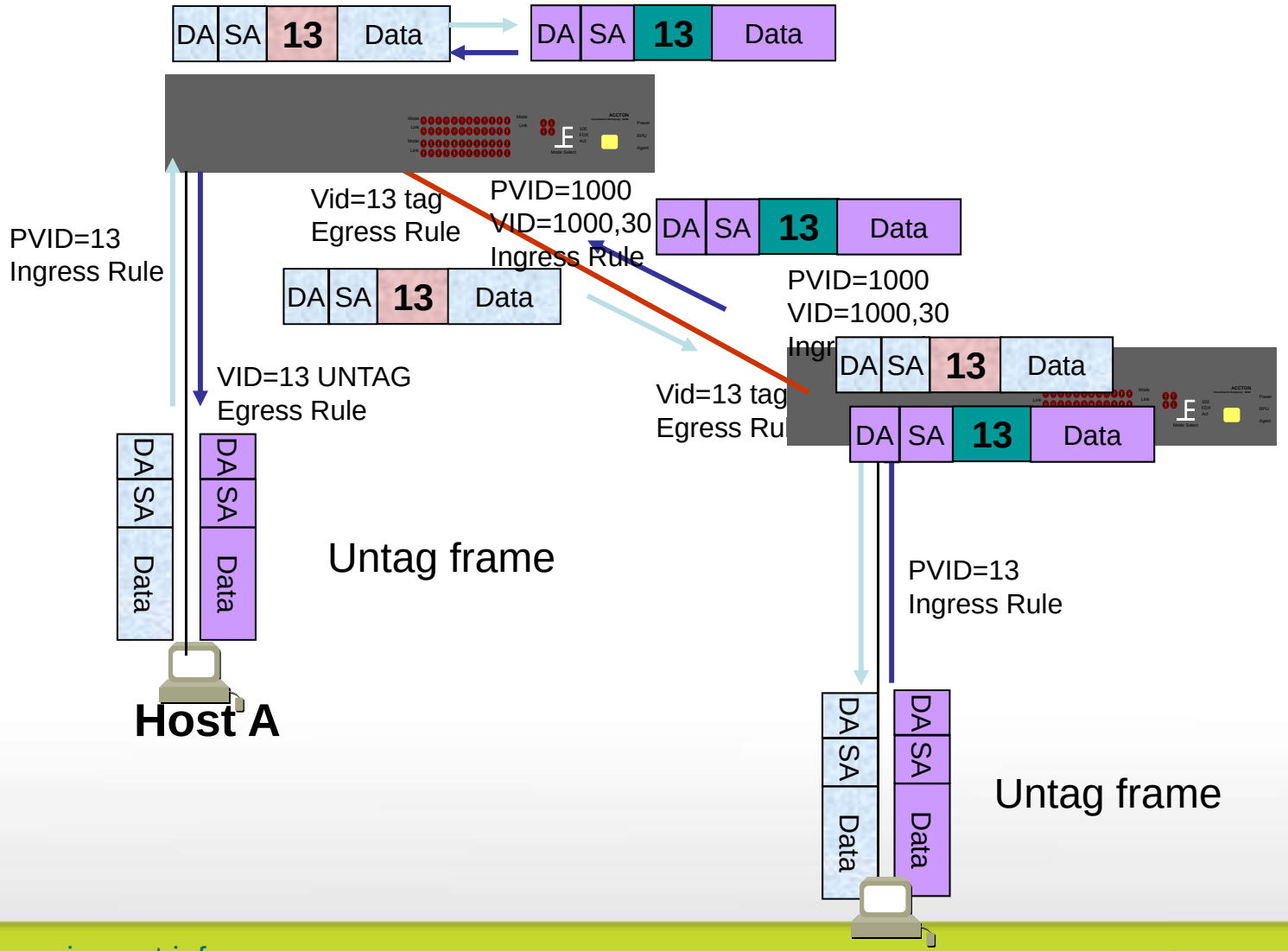
Host A **Host B** **Server**

TAG frame

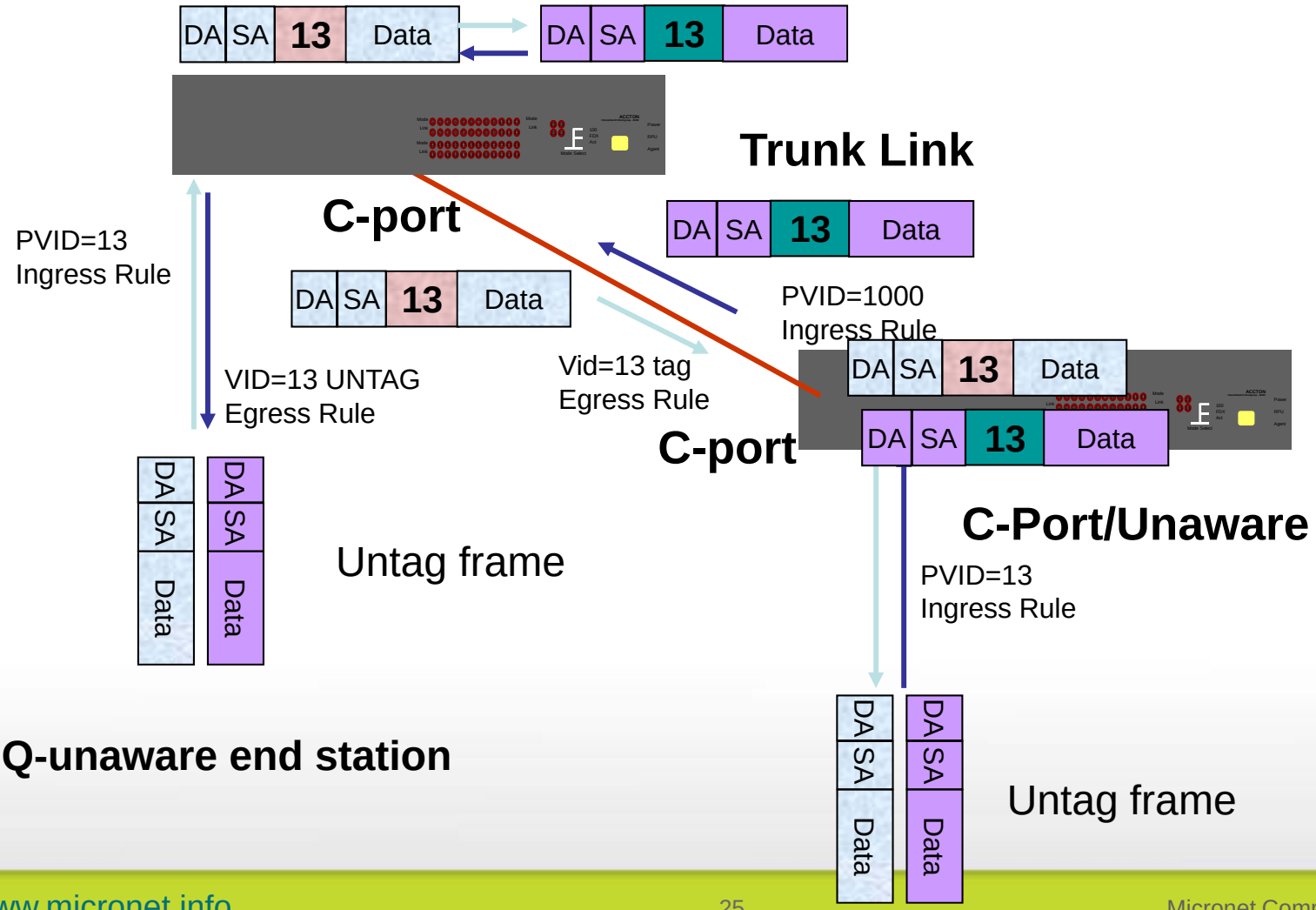
Port	13	18	24
Vlan 2	↺		↺
Vlan 3		↺	↺

Q-aware
Server Port, uplink Port

Multi-switch VLAN



Link Type


DA SA 13 Data
DA SA 13 Data
Trunk Link
C-port
DA SA 13 Data
PVID=13
Ingress Rule
DA SA 13 Data
PVID=1000
Ingress Rule
VID=13 UNTAG
Egress Rule
Vid=13 tag
Egress Rule
DA SA 13 Data
C-port
DA SA 13 Data
C-Port/Unaware
PVID=13
Ingress Rule
DA SA Data
DA SA Data
Untag frame
Q-unaware end station
DA SA Data
DA SA Data
Untag frame

Protocol VLAN
SP6510P8

Protocol VLAN

- Use Data-link layer information to control packet to access VLAN
- Ethernet type
- 802.3-LLC(logic link control)
  - DSCP/SSAP (Destination Service Access Point /Source Service Access Point)
- 802.3-SNAP

Data-Link layer format

- Ethernet frame

Preamble/SFD	Destination Address	Source Address	Type	Data	FCS
7+1 Bytes	6 Bytes	6 Bytes	2 Bytes	46~1500 Bytes	4 Bytes

- 802.3 frame
  - LLC
  - SNAP

Preamble/SFD	Destination Address	Source Address	Length	Data	FCS
7+1 Bytes	6 Bytes	6 Bytes	2 Bytes	46~1500 Bytes	4 Bytes

DSAP	DSAP	Control	Code	Type	Data Packet
1 Byte	1 Byte	1 Byte	3 Byte	2 Byte	38~1492 Bytes

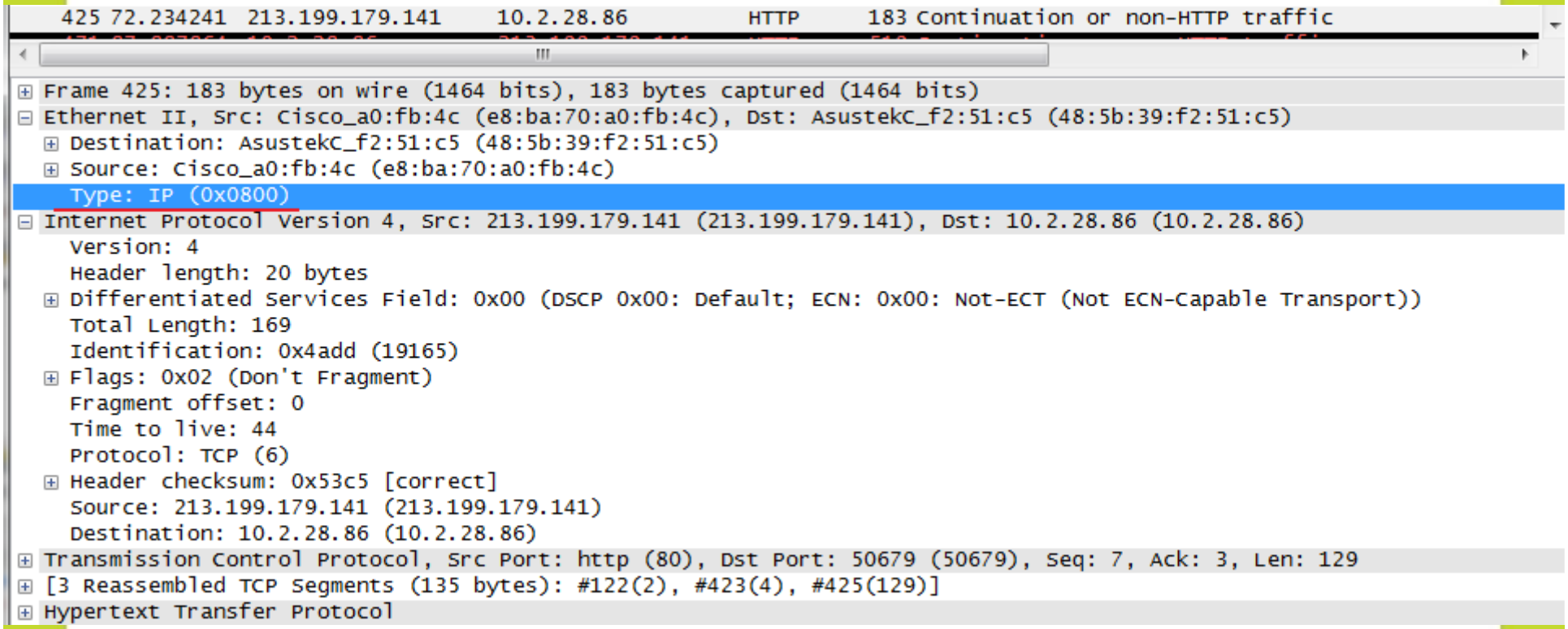
LLC Header SNAP Packet

DSAP	SSAP	Control	Data Packet
1 Byte	1 Byte	1 Byte	43~1497 Bytes

LLC Header

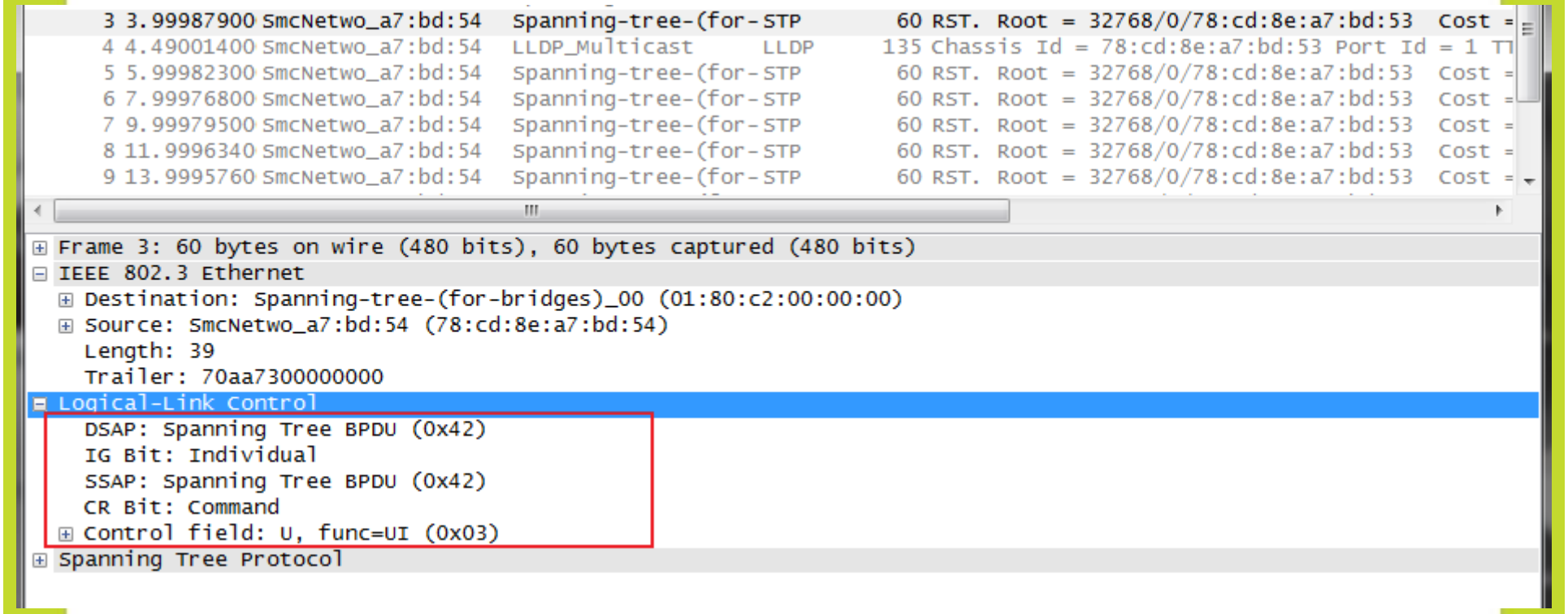
Ethernet II format

- IP


425 72.234241 213.199.179.141 10.2.28.86 HTTP 183 Continuation or non-HTTP traffic
Frame 425: 183 bytes on wire (1464 bits), 183 bytes captured (1464 bits)
Ethernet II, Src: Cisco_a0:fb:4c (e8:ba:70:a0:fb:4c), Dst: AsustekC_f2:51:c5 (48:5b:39:f2:51:c5)
Destination: AsustekC_f2:51:c5 (48:5b:39:f2:51:c5)
Source: Cisco_a0:fb:4c (e8:ba:70:a0:fb:4c)
Type: IP (0x0800)
Internet Protocol Version 4, Src: 213.199.179.141 (213.199.179.141), Dst: 10.2.28.86 (10.2.28.86)
Version: 4
Header length: 20 bytes
Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00: Not-ECT (Not ECN-Capable Transport))
Total Length: 169
Identification: 0x4add (19165)
Flags: 0x02 (Don't Fragment)
Fragment offset: 0
Time to live: 44
Protocol: TCP (6)
Header checksum: 0x53c5 [correct]
Source: 213.199.179.141 (213.199.179.141)
Destination: 10.2.28.86 (10.2.28.86)
Transmission Control Protocol, Src Port: http (80), Dst Port: 50679 (50679), Seq: 7, Ack: 3, Len: 129
[3 Reassembled TCP Segments (135 bytes): #122(2), #423(4), #425(129)]
Hypertext Transfer Protocol

802.3 LLC format

- Spanning Tree BPDU


3 3.99987900 SmcNetwo_a7:bd:54 Spanning-tree-(for-STP 60 RST. Root = 32768/0/78:cd:8e:a7:bd:53 Cost =
4 4.49001400 SmcNetwo_a7:bd:54 LLDP_Multicast LLDP 135 Chassis Id = 78:cd:8e:a7:bd:53 Port Id = 1 TT
5 5.99982300 SmcNetwo_a7:bd:54 Spanning-tree-(for-STP 60 RST. Root = 32768/0/78:cd:8e:a7:bd:53 Cost =
6 7.99976800 SmcNetwo_a7:bd:54 Spanning-tree-(for-STP 60 RST. Root = 32768/0/78:cd:8e:a7:bd:53 Cost =
7 9.99979500 SmcNetwo_a7:bd:54 Spanning-tree-(for-STP 60 RST. Root = 32768/0/78:cd:8e:a7:bd:53 Cost =
8 11.9996340 SmcNetwo_a7:bd:54 Spanning-tree-(for-STP 60 RST. Root = 32768/0/78:cd:8e:a7:bd:53 Cost =
9 13.9995760 SmcNetwo_a7:bd:54 Spanning-tree-(for-STP 60 RST. Root = 32768/0/78:cd:8e:a7:bd:53 Cost =
Frame 3: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
IEEE 802.3 Ethernet
Destination: Spanning-tree-(for-bridges)_00 (01:80:c2:00:00:00)
Source: SmcNetwo_a7:bd:54 (78:cd:8e:a7:bd:54)
Length: 39
Trailer: 70aa7300000000
Logical-Link Control
DSAP: Spanning Tree BPDU (0x42)
IG Bit: Individual
SSAP: Spanning Tree BPDU (0x42)
CR Bit: Command
Control field: U, func=UI (0x03)
Spanning Tree Protocol

802.3 SNAP format

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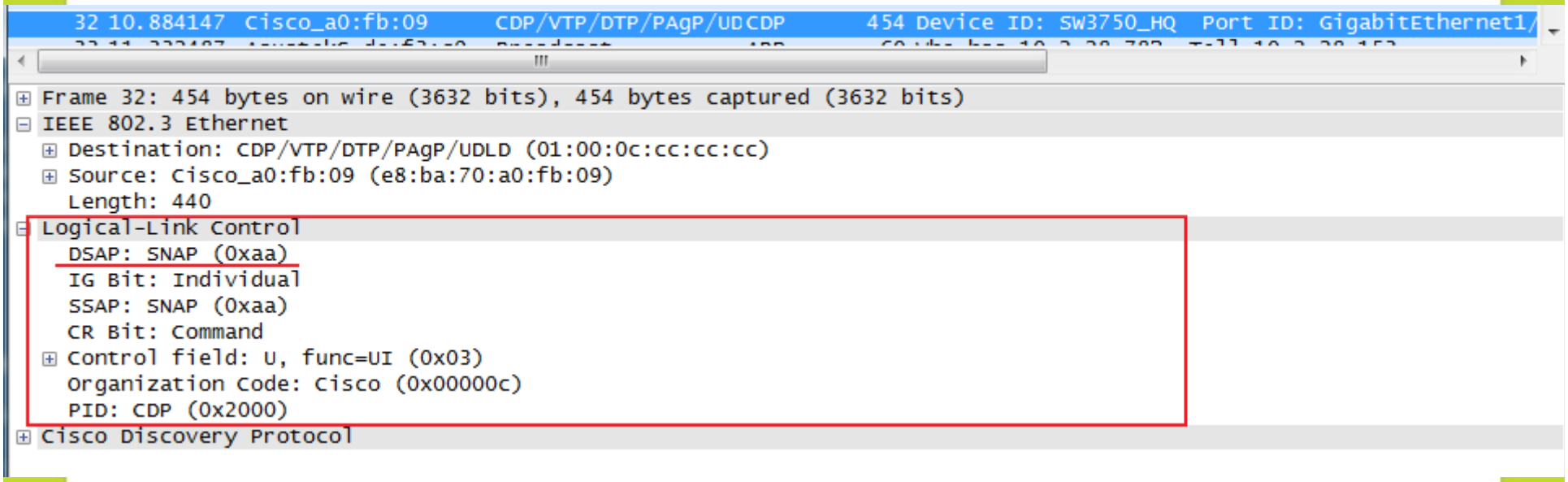
Cisco CDP


32 10.884147 Cisco_a0:fb:09 CDP/VTP/DTP/PAgP/UDCDP 454 Device ID: SW3750_HQ Port ID: GigabitEthernet1/
Frame 32: 454 bytes on wire (3632 bits), 454 bytes captured (3632 bits)
IEEE 802.3 Ethernet
Destination: CDP/VTP/DTP/PAgP/UDLD (01:00:0c:cc:cc:cc)
Source: Cisco_a0:fb:09 (e8:ba:70:a0:fb:09)
Length: 440
Logical-Link Control
DSAP: SNAP (0xaa)
IG Bit: Individual
SSAP: SNAP (0xaa)
CR Bit: Command
Control field: U, func=UI (0x03)
Organization Code: Cisco (0x00000c)
PID: CDP (0x2000)
Cisco Discovery Protocol

Protocol VLAN configuration

- To configure protocol-based VLANs, follow these steps

1. First configure VLAN groups for the protocols you want to use (VLAN member).

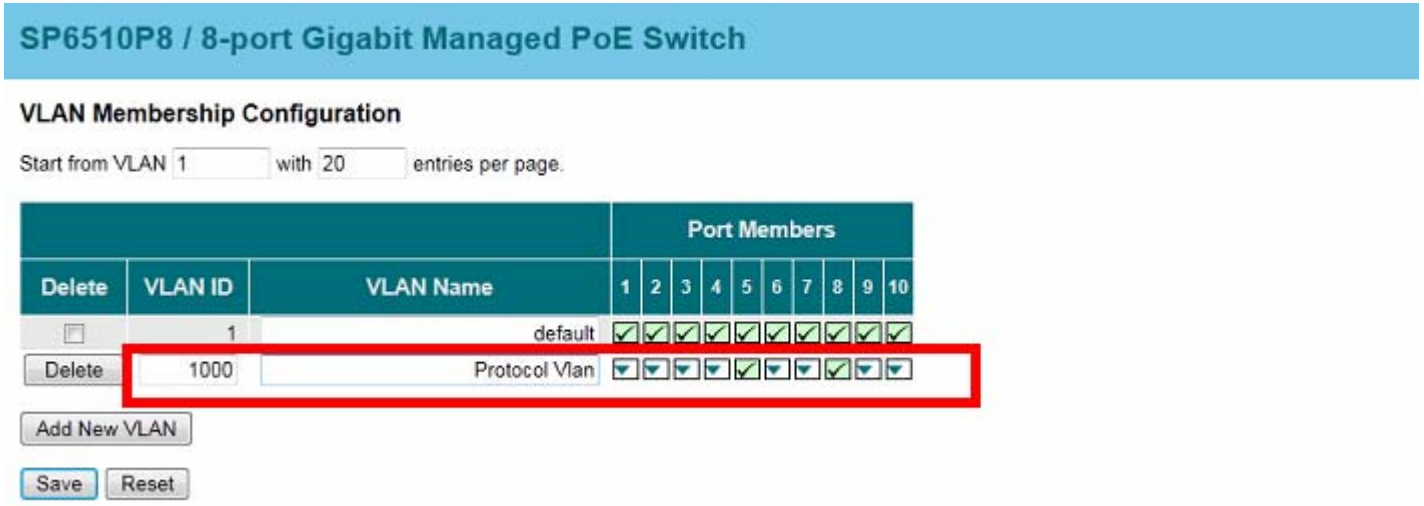
2. Create the protocol group for each interface to the appropriate VLAN.

3. Mapping the group for each of the protocols you want to assign to a VLAN using the Configure Protocol (Add) page.

Protocol VLAN configuration

1. Configuration → VLANs →VLAN member

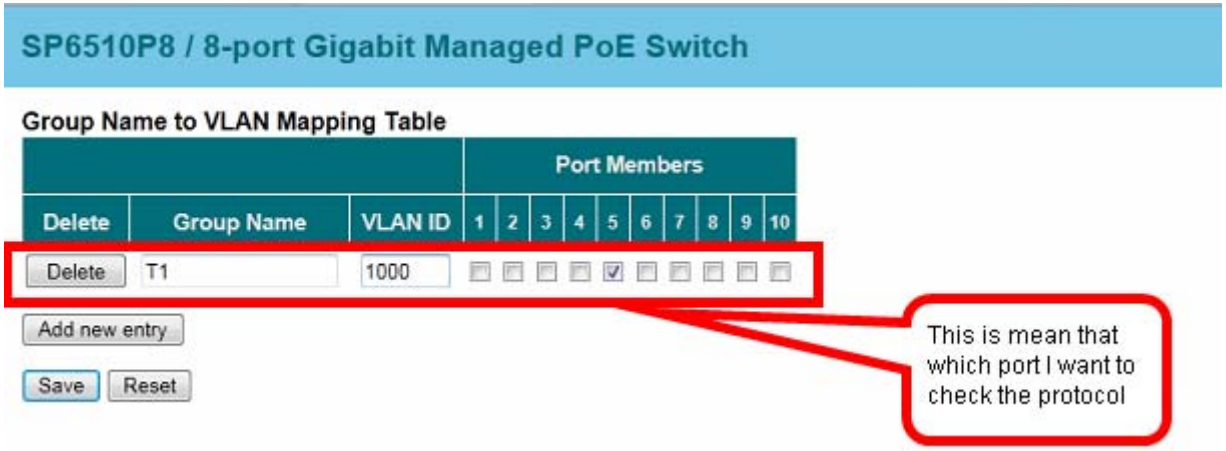
Add port 5 to VLAN 1000



Protocol VLAN configuration

2. Configuration → VCL → Protocol-based → Protocol to Group

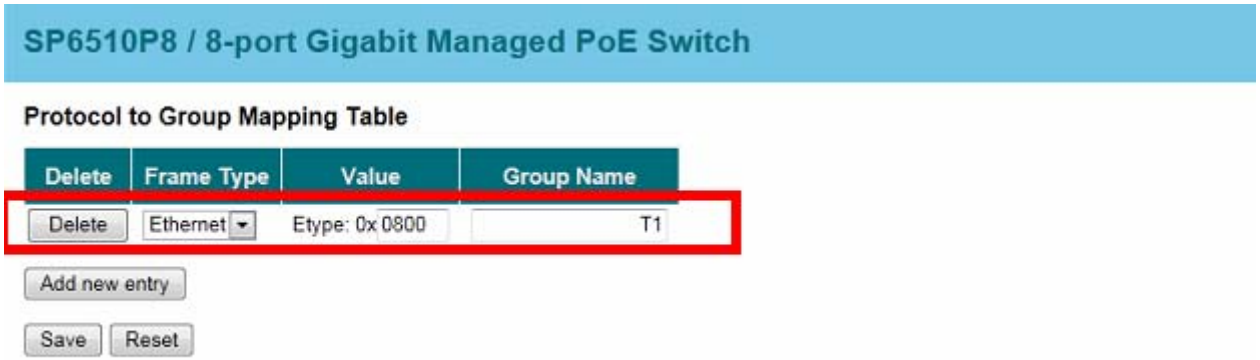
Add protocol vlan 1000 and add port 5. Protocol group name is “T1”



Protocol VLAN configuration

2.3. Configuration → VCL → Protocol-based → Protocol to group

Mapping group “T1” for each protocol you want



Protocol VLAN rule

- Notice: Before creating a protocol-based VLAN, you need to assign interfaces to the VLAN.
- When a frame enters a port that has been assigned to a protocol VLAN, it is processed in the following manner:

1. If the frame is **tagged**, it will be processed according to the standard rules applied to tagged frames.
2. If the frame is **untagged** and the **protocol type matches**, the frame is forwarded to the appropriate VLAN.
3. If the frame is **untagged** but the **protocol type does not match,** the frame is forwarded to the default VLAN for this interface.

Protocol Frame type

- Ethernet – EtherType value. (Range: 0x0600-0xffff; Default: 0x0800)
- LLC – Includes the DSAP and SSAP values. (Range: 0x00-0xff; Default: 0xff)
- SNAP – Includes OUI (Organizationally Unique Identifier) and PID
- (Protocol ID) values:

OUI(Code) : A value in the format of xx-xx-xx where each pair (xx) in the string is a hexadecimal value in the ranges of 0x00-0xff.

PID(Type) : If the OUI is hexadecimal 000000, the protocol ID is the Ethernet type (EtherType) field value for the protocol running on top of SNAP. If the OUI is that of a particular organization, the protocol ID is a value assigned by that organization to the protocol running on top of SNAP. In other words, if value of the OUI field is 00-00-00, then value of the PID will be EtherType (0x0600-0xffff), and if value of the OUI is other than 00-00-00, then valid value of the PID will be any value from 0x0000 to 0xffff.

Voice VLAN
SP6510P8

Voice VLAN

- The Voice VLAN feature enables voice traffic forwarding on the Voice VLAN, then the switch can classify and schedule network traffic.
- It is recommended that there be two VLANs on a port - one for voice, one for data.
- Notice: VoIP devices must send VLAN-tagged packets.
- Use src-mac OUI (00-12-cf-00-00-01) of packets. To decide the VLAN
- Uses LLDP (IEEE 802.1ab) to discover VoIP devices attached to the port. LLDP checks that the “telephone bit” in the system capability TLV is turned on

LLDP system capabilities

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```
125 231.433547 SmcNetwo_a7:bd:54  LLDP_Multicast  LLDP  135 Chassis Id = 78:cd:8e:a7:bd:53 Port Id = 1 TTL = 90
141 261.432680 SmcNetwo_a7:bd:54  LLDP_Multicast  LLDP  135 Chassis Id = 78:cd:8e:a7:bd:53 Port Id = 1 TTL = 90
157 291.431827 SmcNetwo_a7:bd:54  LLDP_Multicast  LLDP  135 Chassis Id = 78:cd:8e:a7:bd:53 Port Id = 1 TTL = 90
173 321.430944 SmcNetwo_a7:bd:54  LLDP_Multicast  LLDP  135 Chassis Id = 78:cd:8e:a7:bd:53 Port Id = 1 TTL = 90
189 351.430026 SmcNetwo_a7:bd:54  LLDP_Multicast  LLDP  135 Chassis Id = 78:cd:8e:a7:bd:53 Port Id = 1 TTL = 90
```

```
⊞ Frame 12: 135 bytes on wire (1080 bits), 135 bytes captured (1080 bits)
⊞ Ethernet II, Src: SmcNetwo_a7:bd:54 (78:cd:8e:a7:bd:54), Dst: LLDP_Multicast (01:80:c2:00:00:0e)
⊟ Link Layer Discovery Protocol
  ⊞ Chassis Subtype = MAC address, Id: 78:cd:8e:a7:bd:53
  ⊞ Port Subtype = Locally assigned, Id: 1
  ⊞ Time To Live = 90 sec
  ⊞ Port Description = Port #1
  ⊞ System Name =
  ⊞ System Description = SMCGS10C-Smart (standalone) Version 1.0.0.3 2011-10-03 08:28:45 +0200
  ⊟ Capabilities
      0000 111. .... .... = TLV Type: System Capabilities (7)
      .... ...0 0000 0100 = TLV Length: 4
    ⊟ Capabilities: 0x0004
        .... .... .... .1.. = Bridge
    ⊞ Enabled Capabilities: 0x0004
  ⊞ Management Address
  ⊞ End of LLDPDU
```

Other = 0000 0000 0000 0001
Repeater = 0000 0000 0000 0010
Bridge = 0000 0000 0000 0100
wlanAccess Poin = 0000 0000 0000 1000
Router = 0000 0000 0001 0000
Telephone = 0000 0000 0010 0000

Voice VLAN configuration(1)

- Mode: Enable /Disable Voice VLAN
- VLAN ID: Voice VLAN ID
- Aging time: Indicates the Voice VLAN secure learning aging tim(Range: 10-10000000 sec. Default is 100 sec)
- Traffic Class: Indicates the Voice VLAN traffic class. All traffic on the Voice VLAN will apply this class.

Voice VLAN configuration(2)

- Port Mode:
  - Disabled(default): Disjoin from Voice VLAN.
  - Auto: Enable auto detect mode. It detects whether there is VoIP phone attached to the specific port and configures the Voice VLAN members automatically.
  - Forced: Force join to Voice VLAN.
- Port Security: Indicates the Voice VLAN port security mode. When the function is enabled, all non-telephonic MAC addresses in the Voice VLAN will be blocked for 10 seconds. (default is Disabled)
- Port Discovery Protocol: Indicates the Voice VLAN port discovery protocol.
  - OUI(Default): Detect telephony device by OUI address.
  - LLDP: Detect telephony device by LLDP.
  - Both: Both OUI and LLDP.

Voice VLAN configuration

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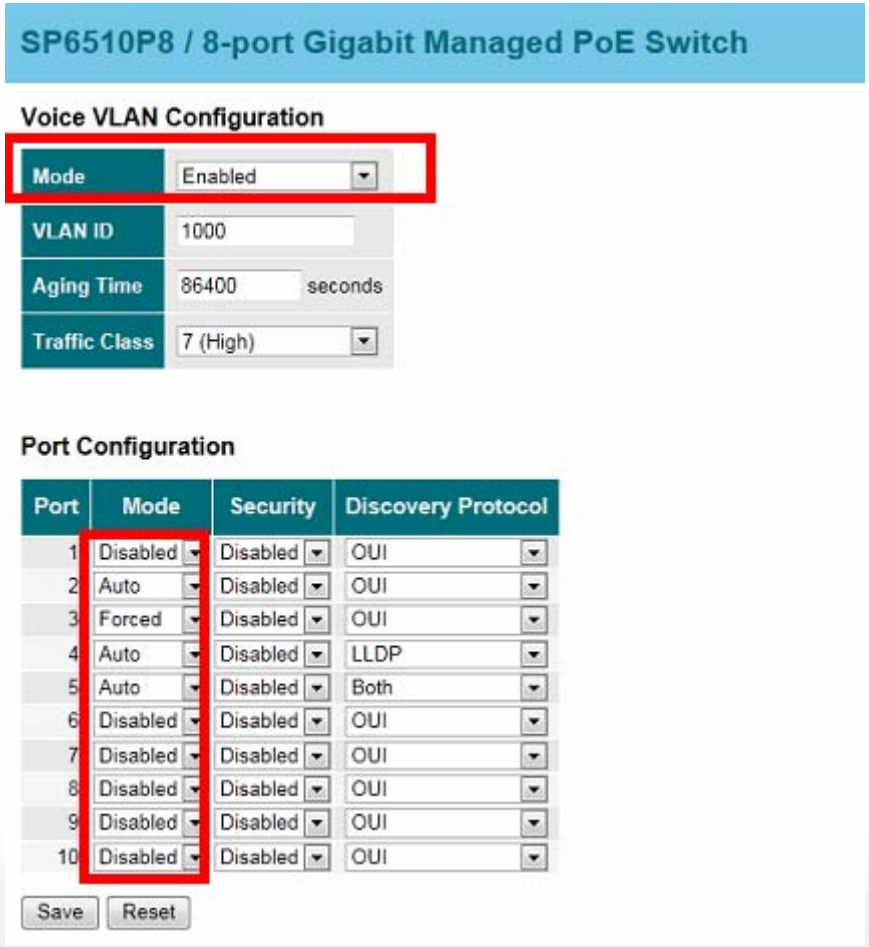
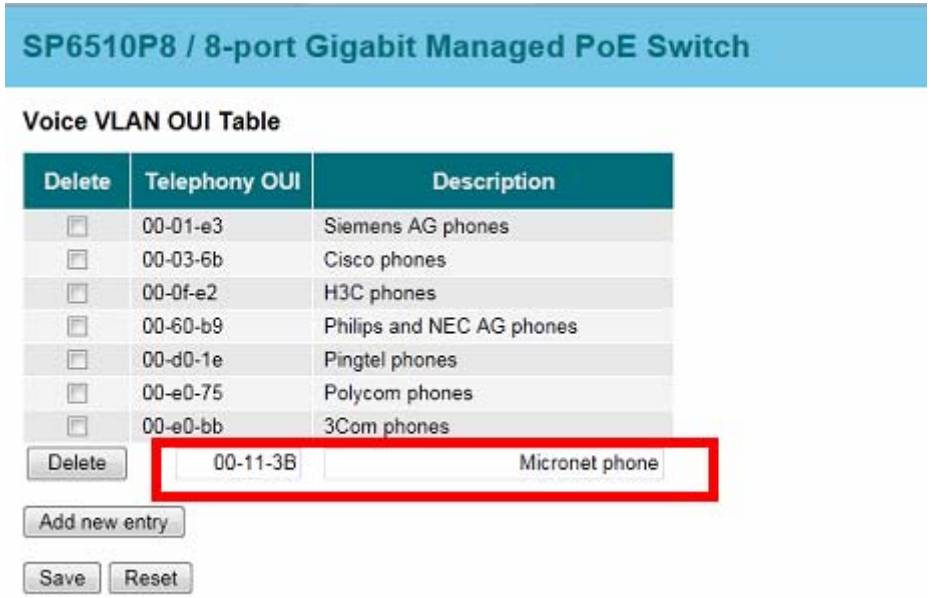
Configuration→ Voice VLAN → configuration



Voice VLAN configuration

Configuration→ Voice VLAN → OUI



LLDP system capabilities format

Other (0) = 0000 0000 0000 0001
Repeater (1) = 0000 0000 0000 0010
Bridge (2) = 0000 0000 0000 0100
WlanAccessPoint (3) = 0000 0000 0000 1000
Router (4) = 0000 0000 0001 0000
Telephone (5) = 0000 0000 0010 0000
DocsisCableDevice (6) = 0000 0000 0100 0000
stationOnly (7) = 0000 0000 1000 0000

Reference: LLDP-MIB

Q & A

THANK YOU!